

Claims

What is claimed is:

1. A method for trimming a fuel injector located on an engine, comprising the steps of:
 - modifying an engine speed control;
 - interrupting at least one injection event;
 - monitoring a change associated with an engine speed; and
 - responsively trimming the injector.
2. A method, as set forth in claim 1, wherein modifying an engine speed control includes the step of loosening an engine speed control to allow changes in engine speed within a desired range.
3. A method, as set forth in claim 2, wherein engine speed control is a proportional-integral control and modifying an engine speed control includes the steps of:
 - modifying a gain of the proportional control; and
 - selectively disabling the integral control.
4. A method, as set forth in claim 1, wherein interrupting at least one injection event includes the step of interrupting at least one of a pilot and a main injection event.
5. A method, as set forth in claim 4, wherein interrupting at least one injection event includes the step of cutting out at least one injection event.

6. A method, as set forth in claim 5, wherein interrupting at least one injection event includes the steps of:

cutting out a main injection event; and
subsequently cutting out a pilot injection event while the main injection event is cut out.

7. A method, as set forth in claim 5, wherein interrupting at least one injection event includes the step of cutting out one of a main and a pilot injection event.

8. A method, as set forth in claim 1, wherein monitoring a change associated with an engine speed includes the step of monitoring a change in engine speed.

9. A method, as set forth in claim 1, wherein monitoring a change in engine speed includes the step of monitoring a time for a change from a first engine speed to a second engine speed.

10. A method, as set forth in claim 1, wherein monitoring a change associated with an engine speed includes the steps of:
determining a reference speed subsequent to modifying the engine speed control;
interrupting a first injection event;
determining a first change in engine speed from the reference speed in response to interrupting the first injection event;
interrupting a second injection event; and
determining a second change in engine speed from the first change in engine speed in response to interrupting the second injection event.

11. A method, as set forth in claim 1, wherein interrupting at least one injection event includes the steps of:

- determining a reference speed subsequent to modifying the engine speed control;
- interrupting a main injection event;
- determining a first change in engine speed from the reference speed in response to interrupting the main injection event;
- interrupting a pilot injection event during interruption of the main injection event; and
- determining a second change in engine speed from the first change in engine speed in response to interrupting the pilot injection event.

12. A method, as set forth in claim 1, wherein the engine includes a plurality of fuel injectors located thereon, further including the steps of:

- interrupting at least one injection event for a first injector;
- monitoring a change associated with the engine speed;
- restoring the at least one injection event to the first injector; and
- repeating the interrupting and speed monitoring steps for each of the plurality of injectors.

13. A method, as set forth in claim 12, further including the steps of:

- determining an average engine speed change based on the interrupting and speed monitoring steps; and
- trimming each of the plurality of fuel injectors as a function of the average speed change.

14. A method for trimming a fuel injector located on an engine, comprising the steps of:
modifying an engine speed control;
interrupting a main injection event;
determining a first speed change;
interrupting a pilot injection event while maintaining the main injection event interruption;
determining a second speed change; and
trimming the fuel injector as a function of the first and second speed changes.

15. A method, as set forth in claim 14, wherein trimming the fuel injector includes the step of modifying a duration of at least one fuel injection event.

16. A method for trimming a plurality of fuel injectors located on an engine, comprising the steps of:
a) modifying an engine speed control;
b) interrupting at least one injection event for a first injector;
c) monitoring an engine speed change;
d) repeating steps b) and c) for each additional fuel injector;
e) determining an average engine speed change; and
f) responsively trimming each fuel injector.

17. A method, as set forth in claim 16, further including the step of restoring the engine speed control.

18. An apparatus for trimming a fuel injector located on an engine, comprising:

- an engine speed control device;
- an engine speed sensor; and
- a controller for modifying an engine speed control of the engine speed control device, interrupting at least one injection event, monitoring a change in engine speed, and responsively trimming the injector.

19. An apparatus for trimming a fuel injector located on an engine, comprising:

- means for modifying an engine speed control;
- means for interrupting at least one injection event;
- means for monitoring a change associated with an engine speed;

and

- means for responsively trimming the injector.

20. A method for balancing multiple injection events of a fuel injector located on an engine, comprising the steps of:

- interrupting a first injection event;
- monitoring a change associated with an engine speed;
- interrupting a second injection event;
- monitoring a further change associated with the engine speed; and
- trimming the first and second injection events as a function of the engine speed changes.

21. A method, as set forth in claim 20, further including the step of modifying an engine speed control during the interrupting and speed monitoring steps.